Space Weather Technical Forecast

Issued on Friday 15 November 2024 at 01:08 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Isolated R1/R2 radio blackouts possible. Slight chance of G1/Minor Geomagnetic Storm intervals.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low during the past 24-hours with only C-class flares, the largest of which a C3.2 at 13/2259 UTC from previous region AR3886.

There are five sunspot regions on the visible disc. AR3889, in the southwest, remains the largest and most complex region on the disc with a Fki/beta-gamma-delta classification. The remaining regions are relatively small and simple.

No CMEs observed over the past 24 hours are considered to have an Earth-directed component.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE were initially indicative of a slow regime but rose steadily from approximately 14/0300UTC under the likely influence of a weak high speed stream, reaching between 380-410km/s. Later in the day winds decreased slightly, to around 350 km/s. Density initially average to below average decreased following HSS arrival. The interplanetary magnetic field (IMF), Bt, initially weak, also saw a steady increase following HSS arrival, becoming persistently moderate, with a peak around 14nT. The north-south component, Bz, initially varied weakly. The Bz varied at moderate levels following HSS arrival, with a predominantly moderate negative spell of Bz between 14/0930 UTC and late in the day, reaching -12 nT at 14/1615 UTC. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 0-3), apart for an Active (Kp 4) interval 14/1800-2100 UTC.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at low to moderate levels, peaking at 189 pfu at 14/040 UTC. The associated 24-hour fluence remained below the Active threshold. The integrated flux observed at 15/0000 UTC was 3.786e6.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity expected, with a chance of M-class flares and a slight chance of X-class flares, mostly from AR3889.

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Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast.

Background to slightly elevated solar wind speeds are expected, although from late day 3 (17th) there is a chance of Elevated wind speeds of around 500km/s occurring with a connection to a HSS. Geomagnetic activity is expected to be Unsettled to Active (Kp 3-4) initially, with a slight chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals. Through today activity will decline slightly, becoming Quiet to Unsettled (Kp 1-3). Then from late day 3 activity will increase slightly again, becoming Unsettled to Active (Kp 3-4) with a chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is at background levels. There is a slight chance of S1/Minor solar radiation storms due to the potential for flaring from AR3889 as it rotates across the western hemisphere.

The high energy electron flux is expected to remain at predominantly background to moderate levels, although there is a chance of reaching high levels during diurnal peaks. The associated fluence is expected to remain below Active (1e8 integrated flux) levels.

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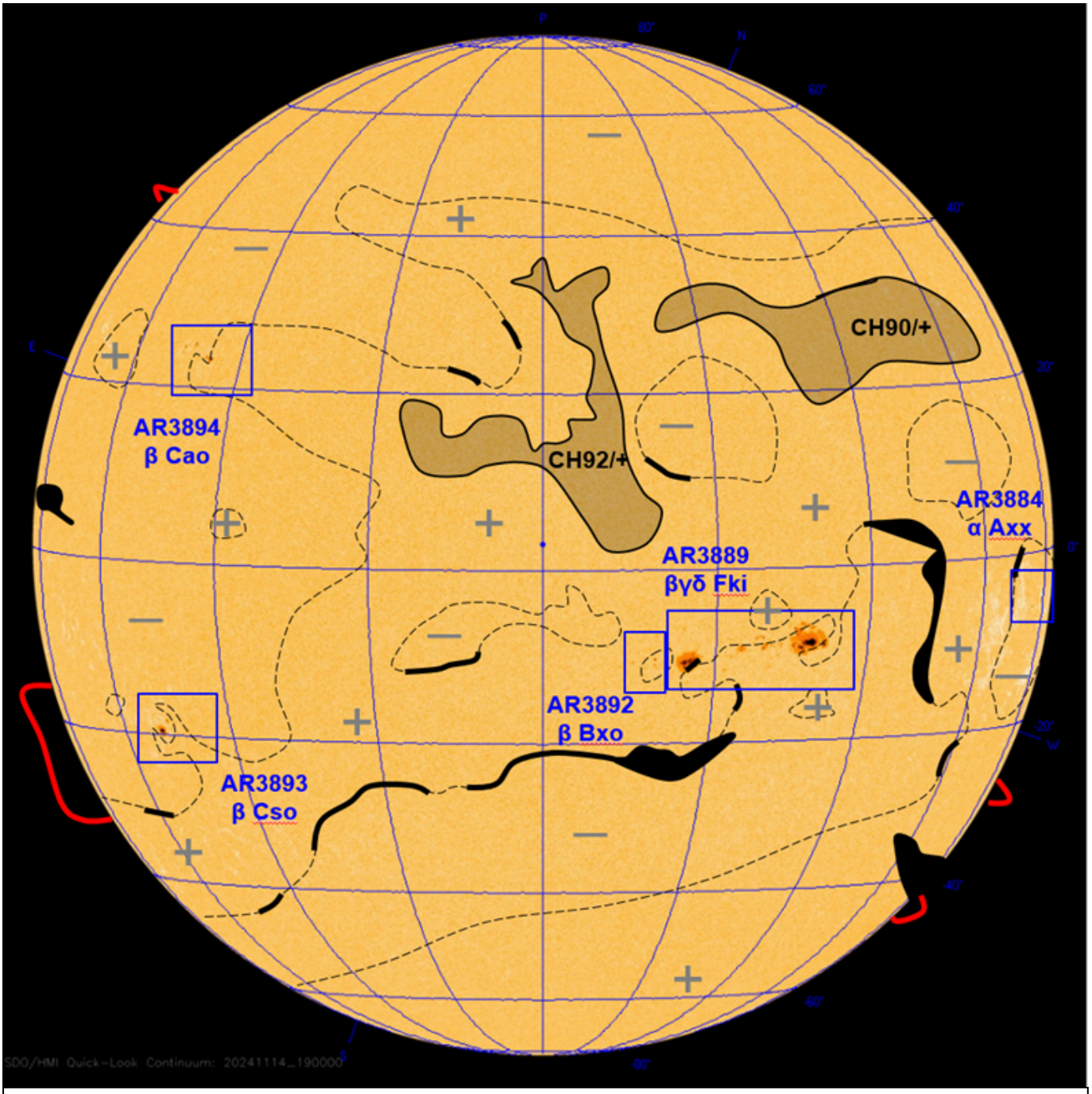
Figure 1: Synoptic Map valid 14/1900 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

A narrow CME seen to emerge from just south of AR3889 starting from 15/1245 UTC, and another slightly larger CME from a prominence eruption on the SE limb around 14/2000 UTC. Neither CME is expected to be Earth directed. There is also a number of filaments which have shown signs of instability and warrant monitoring for potential sources of CMEs during the period.

The four-day forecast comprises primarily of coronal hole influences. Further weak and temporary connections to a HSS from CH90/+ is possible, as Earth brushes along the southern boundary of this coronal hole, bringing occasional slightly elevated solar wind speeds, mainly today and tomorrow. From late day 3 (17th) there is a chance of Elevated wind speeds of around 500km/s occurring with a connection to a HSS from CH92, as this feature is slightly larger compared to last rotation, when speeds of around 450 km/s occurred.

Geomagnetic activity is expected to be Unsettled to Active (Kp 3-4) initially, with a slight chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals. Through today activity will decline slightly, becoming Quiet to Unsettled (Kp 1-3). Then from late day 3 activity will increase slightly again, becoming Unsettled to Active (Kp 3-4) with a chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	10	30	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Figure 2: Latest MOSWOC Enlil model, indicating a later than expected HSS arrival from CH92.

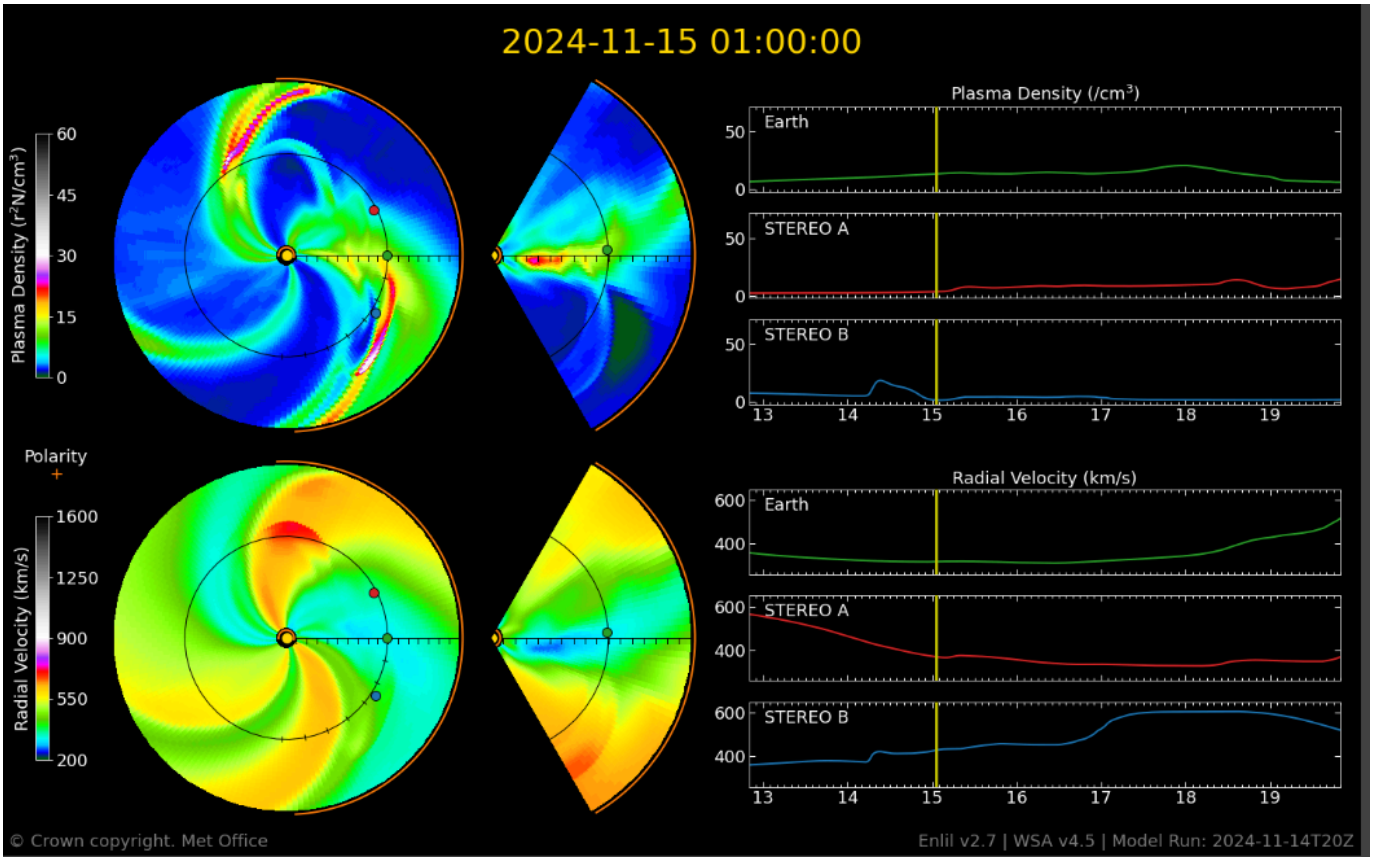

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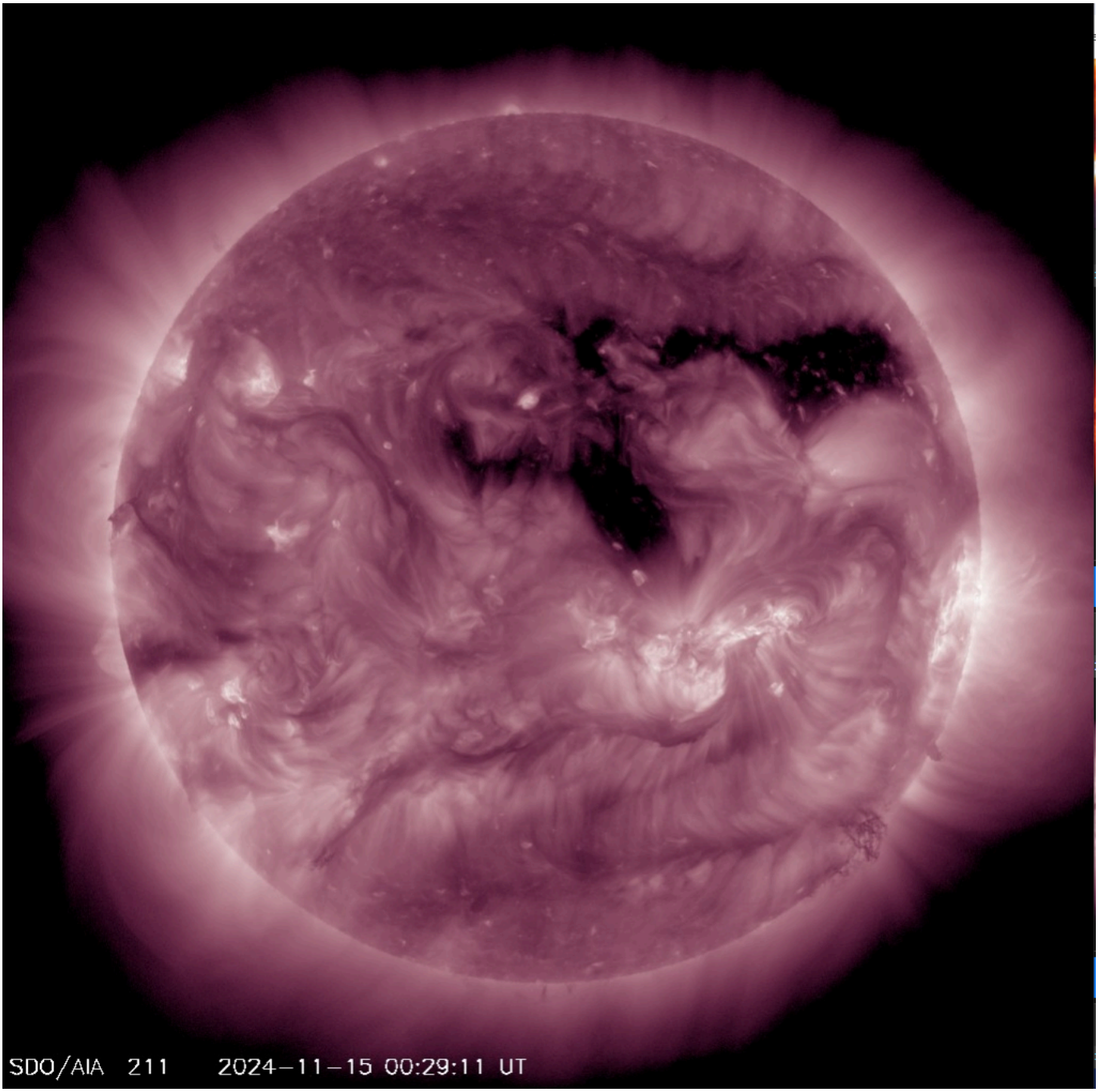
Figure 3: Latest SDO/AIA 211 image showing CH90 and CH92.



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Radio Blackouts - X-Ray Flares

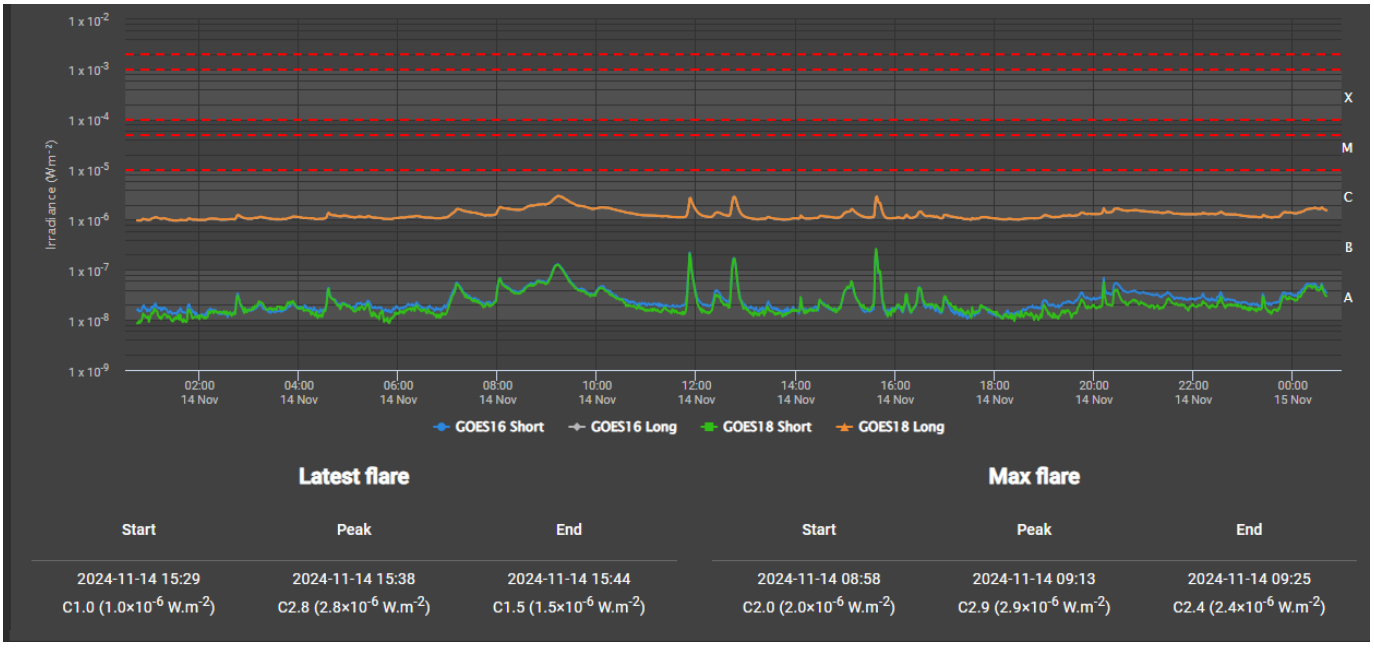
Solar activity was Low during the past 24-hours with only C-class flares, the largest of which a C3.2 at 13/2259 UTC from previous region AR3886.

There are five sunspot regions on the visible disc, with AR3884 barely visible as it approaches the west limb. AR3889, in the southwest, remains the largest and most complex region on the disc, despite loosing a small delta spot within the leading portion of the region. Another delta spot persists within the penumbra of an intermediate spot, although this delta spot is small and weak. The remaining regions are relatively small and simple, with AR3894 continuing to show slight growth.

Overall Low to Moderate activity is likely, with a chance of isolated M-flares and a slight chance of X-flares, most likely from AR3889. However, later in the forecast period returning regions may rotate onto the visible disc, potentially increasing the likelihood of significant flares.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	40	40	40	40
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 4: Past 24 hours of X-Ray flares.



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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is at background levels and is likely to remain that way during the period in the absence of any significant flare activity.

There is a slight chance of S1/Minor Solar Radiation storms over the period, chiefly due to any potential significant flaring from AR3889 as it increasingly rotates across the western hemisphere.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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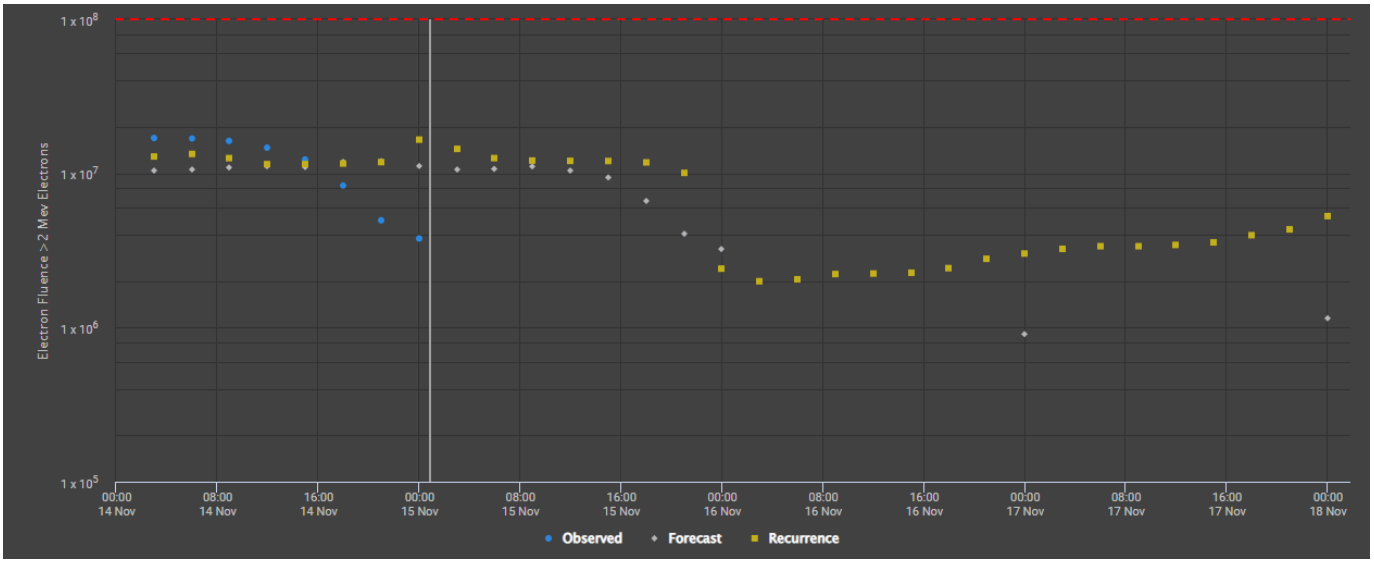
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is at background to moderate levels, with no change expected, apart for a slight chance of temporarily reaching high levels during diurnal peaks.

The associated fluence is expected to remain below Active (1e8 integrated flux) levels, with a gradually rising trend. Therefore the guidance shown by MOSWOC's REFM model is considered reasonable guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^8	No	1	5	10	20
Very Active	≥ 2 MeV ≥ 1×10^9	No	1	1	1	1

Figure 5: Latest MOSWOC REFM model.



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